

WHAT IS CLAIMED IS:

1. An ink sheet cartridge, comprising:  
four spools;  
a cartridge body that rotatably supports the four spools;  
an intermediate connector having a substantially-cylindrical shape and  
detachably connected to one of the four spools and unconnected to remaining three of the four  
spools;

a supply-side core tube having two ends opposite from each other;  
a takeup-side core tube having two ends opposite from each other; and  
an ink sheet wound around and expanding between the supply-side core tube  
and the takeup-side core tube, wherein the intermediate connector and the remaining three of  
the four spools are detachably engaged with the corresponding ends of the supply-side core  
tube and the takeup-side core tube.

2. The ink sheet cartridge according to claim 1, wherein the intermediate  
connector includes a cam portion, and the one of the four spools is formed with an  
engagement pawl for engaging the cam portion.

3. The ink sheet cartridge according to claim 2, wherein the cartridge body  
includes a side plate formed with a supporting hole, and the one of the four spools includes a  
rotation member and a shaft member, the rotation member including a transmission gear and  
a resilient member protruding from the transmission gear, the shaft member including a  
flange and being unreleasably engaged with the rotation member within the supporting hole  
while interposing the side plate between the transmission gear and the flange, wherein the  
cam portion has an inner diameter portion that engages the engagement pawl, the engagement  
pawl being provided at a tip end of the resilient member.

4. The ink sheet cartridge according to claim 3, wherein the inner diameter  
portion of the cam portion is divided in a radial direction, and the rotation member is  
rotatable in a winding direction and an unwinding direction opposite from the winding  
direction, and the engagement pawl of the rotation member engages the cam portion only  
when the rotation member rotates in the winding direction in order to integrally rotation the  
intermediate connector in the winding direction.

5. The ink sheet cartridge according to claim 1, wherein the intermediate  
connector has an outer diameter, and the takeup-side core tube has an outer diameter equal to  
the outer diameter of the intermediate connector, wherein one of the two ends of the takeup-

side core tube is formed with an engagement groove, and the intermediate connector has an engagement protrusion engageable with the engagement groove.

6. The ink sheet cartridge according to claim 1, wherein the intermediate connector and the remaining three of the four spools are detachable from the corresponding ends of the supply-side core tube and the takeup-side core tube without detaching the one of the four spools from the cartridge body.

7. The ink sheet cartridge according to claim 6, wherein the cartridge body includes a side plate formed with a support hole, and the one of the four spools includes a shaft member and a rotation member engageable with the shaft member, the shaft member including a flange, the rotation member including a transmission gear, wherein rotation member engages the shaft member within the support hole while the flange and the transmission gear sandwich the side plate therebetween.

8. The ink sheet cartridge according to claim 7, wherein the shaft member further includes an engagement member protruding from the flange for engaging the rotation member, and the side plate has an inner side and an outer side opposite from the inner side, the engagement member engaging the rotation member within the support hole such that the flange is positioned the inner side of the side plate and the transmission gear is positioned the outer side of the side plate.

9. The ink sheet cartridge according to claim 7, wherein the shaft member and the rotation member engaged with the shaft member together define an engagement portion that functions as a rotational center of the one of the four spools.

10. The ink sheet cartridge according to claim 1, wherein the one of the four spools is formed with an engagement hole, and one of the ends of the supply-side core tube and the takeup-side core tube is formed with an engagement groove, and the intermediate connector is formed with a first protrusion for engaging the engagement hole and a second protrusion for engaging the engagement groove.

11. The ink sheet cartridge according to claim 10, wherein the one of the four spools includes a shaft member and a rotation member engageable with the shaft member, the shaft member including a flange, the rotation member including a transmission gear, and the cartridge body includes a side plate formed with a support hole, wherein the shaft member and the rotation member engages each other within the support hole while interposing the side plate between the flange and the transmission gear, and the flange is formed with a plurality of engagement holes arranged in a peripheral direction of the flange.

12. The ink sheet cartridge according to claim 1, wherein the intermediate connector is formed from a material having a relatively high friction coefficient and serves as a torque limiter that regulates transmission of torque from the one of the four spools to one of the supply-side core tube and the takeup-side core tube.

13. The ink sheet cartridge according to claim 12, wherein the intermediate connector is formed from a rubber.

14. The ink sheet cartridge according to claim 13, wherein the intermediate connector is rotatable with respect to the one of the ends of the supply-side core tube and the takeup-side core tube.

15. An ink sheet set detachably mountable on an ink sheet cartridge including four spools, a cartridge body freely rotatably supporting the four spools, and an intermediate connector having a substantially-cylindrical shape and connected to one of the four spools and unconnected to remaining three of the four spools, the ink sheet set comprising:

- a supply-side core tube having two ends opposite from each other;
- a takeup-side core tube having two ends opposite from each other; and
- an ink sheet wound around and expanding between the supply-side core tube and the takeup-side core tube, wherein

each of the ends of the supply-side core tube and the takeup-side core tube is detachably engageable with corresponding one of the intermediate connector and the remaining three of the four spools.

16. The ink sheet set according to claim 15, wherein the takeup-side core tube has an outer diameter equal to an outer diameter of the intermediate connector, and one of the ends of the takeup-side core tube is formed with an engagement groove engageable with an engagement protrusion formed to the intermediate connector.

17. An ink sheet set detachably mountable on an ink sheet cartridge including four spools and a cartridge body freely rotatably supporting the four spools, the ink sheet set comprising:

- a supply-side core tube having two ends opposite from each other;
- a takeup-side core tube having two ends opposite from each other;
- an ink sheet wound around and expanding between the supply-side core tube and the takeup-side core tube; and

an intermediate connector having a substantially-cylindrical shape, the intermediate connector being detachably engaged with one of the ends of the supply-side core

tube and the takeup-side core tube and unengaged with remaining three of the ends of the supply-side core tube and takeup-side core tube, wherein the intermediate connector and the remaining three of the ends are engageable with corresponding ones of the four spools.

18. The ink sheet set according to claim 17, wherein the intermediate connector has a cam portion engageable with an engagement pawl formed to one of the four spools.

19. The ink sheet set according to claim 18, wherein the cam portion is in engagement with the engagement pawl when the one of the four spools rotates in a winding direction and in disengagement with the engagement pawl when the one of the four spools rotates in an unwinding direction opposite from the winding direction.

20. The ink sheet set according to claim 17, wherein the intermediate connector has an outer diameter, and the takeup-side core tube has an outer diameter equal to the outer diameter of the intermediate connector, and the one of the ends of the takeup-side core tube is formed with an engagement groove, and the intermediate connector is formed with an engagement protrusion engageable with the engagement groove.

21. The ink sheet set according to claim 17, wherein the intermediate connector is formed with a plurality of engagement protrusions engageable with corresponding ones of engagement grooves formed to the one of the four spools.

22. The ink sheet set according to claim 17, wherein the intermediate connector is formed from a material having a relatively high friction coefficient and serves as a torque limiter that regulates transmission of torque from the one of the four spools to one of the supply-side core tube and the takeup-side core tube.

23. The ink sheet set according to claim 22, wherein the intermediate connector is formed from a rubber.

24. The ink sheet set according to claim 23, wherein the intermediate connector is rotatable with respect to the one of the ends of the supply-side core tube and the takeup-side core tube.

25. An intermediate connector for use in an ink sheet cartridge of an image forming device, the ink sheet cartridge including four spools each having an outer diameter portion, a cartridge body freely rotatably supporting the four spools, a pair of core tubes each having two ends and an inner diameter portion, and an ink sheet wound around and expanding between the pair of core tubes, the intermediate connector comprising:

a body having a substantially-cylindrical shape having a first portion that is insertable into the inner diameter portion of one of the pair of core tubes and a second portion

integrally formed with the first portion, the second portion having an inner diameter portion receivable the outer diameter portion of one of the four spools, thereby connecting the one of the four spools with the one of the pair of core tubes.

26. The intermediate connector according to claim 25, wherein the body is formed with a cam portion that engages an engagement pawl formed to the one of the four spools.

27. The intermediate connector according to claim 26, wherein the cam portion is formed to the inner diameter portion of the second portion.

28. The intermediate connector according to claim 27, wherein the inner diameter portion is divided in a radial direction, thereby defining the cam portion, the cam portion being in engagement with the engagement pawl when the one of the spools rotates in a winding direction and in disengagement with the engagement pawl when the one of the spools rotates in an unwinding direction opposite from the winding direction.

29. The intermediate connector according to claim 25, wherein the second portion has an outermost diameter that is equal to an outer diameter of the one of the pair of core tubes, and the second portion is formed with an engagement protrusion engageable with an engagement groove formed to the one of the ends of the pair of core tubes.

30. The intermediate connector according to claim 25, wherein the second portion has a side surface formed with a protrusion that detachably engages an engagement hole formed to the one of the four spools.

31. The intermediate connector according to claim 30, wherein the second portion of the body further includes another protrusion that detachably engages an engagement groove formed to the one of the ends of the pair of core tubes.

32. The intermediate connector according to claim 25, wherein the body is formed from a material having a relatively high friction coefficient and serves as a torque limiter that regulates transmission of torque from the one of the four spools to the one of the pair of core tubes.

33. The intermediate connector according to claim 32, wherein the body is formed from a rubber.

34. The intermediate connector according to claim 33, wherein the body is rotatable with respect to the one of the ends of the pair of core tubes.

35. A cartridge set used in an ink sheet cartridge of an image forming device, the ink sheet cartridge including four spools and a cartridge body freely rotatably supporting the four spools, the cartridge set comprising:

a takeup-side core tube having two ends opposite from each other; and an intermediate connector having a substantially-cylindrical shape, the intermediate connector connecting one of the two ends of the takeup-side core tube and one of the four spools.

36. The cartridge set according to claim 35, wherein the intermediate connector is formed with a cam portion engageable with an engagement pawl formed to one of the four spools.

37. The cartridge set according to claim 36, wherein the cam portion of the intermediate connector has an inner diameter portion that is engageable with the engagement pawl.

38. The cartridge set according to claim 37, wherein the inner diameter portion is divided in a radial direction, the inner diameter portion being in engagement with the engagement pawl when the one of the spools rotates in a winding direction and in disengagement with the engagement pawl when the one of the spools rotates in an unwinding direction opposite from the winding direction.

39. The cartridge set according to claim 35, wherein the intermediate connector has an outer diameter, and the takeup-side core tube has an outer diameter that is equal to the outer diameter of the intermediate connector, and the one of the ends of the takeup-side core tube is formed with an engagement groove, and the intermediate connector is formed with an engagement protrusion engageable with the engagement groove.

40. The cartridge set according to claim 35, wherein the one of the two ends of the takeup-side core tube is formed with an engagement groove, and the intermediate connector is formed with a first protrusion engageable with the engagement groove and a second protrusion engageable with an engagement hole formed to the one of four spools.

41. The cartridge set according to claim 35, wherein the intermediate connector is formed from a material having a relatively high friction coefficient and serves as a torque limiter that regulates transmission of torque from the one of the four spools to one of the ends of the takeup-side core tube.

42. The cartridge set according to claim 41, wherein the intermediate connector is formed from a rubber.

43. The cartridge set according to claim 42, wherein the intermediate connector is rotatable with respect to the one of the ends of the takeup-side core tube.

44. An ink sheet set, comprising:

a supply-side core tube having two ends opposite from each other;  
a takeup-side core tube having two ends opposite from each other;  
an ink sheet wound around and expanding between the supply-side core tube  
and the takeup-side core tube; and

an intermediate connector having a substantially-cylindrical shape, the  
intermediate connector being engaged with one of the ends of the supply-side core tube and  
the takeup-side core tube.

45. The ink sheet set according to claim 44, wherein the intermediate connector is  
unengaged with remaining three of the ends of the supply side core tube and takeup-side core  
tube.

46. An intermediate connector for use in an ink sheet set including a pair of core  
tubes each having two ends and an inner diameter portion, and an ink sheet wound around  
and expanding between the pair of core tubes, the intermediate connector comprising:

a body having a substantially-cylindrical shape having a first portion that is  
insertable into the inner diameter portion of one of the pair of core tubes and a second portion  
integrally formed with the first portion.

47. The intermediate connector according to claim 46, wherein the intermediate  
connector receives a specific spool having an engagement pawl.

48. The intermediate connector according to claim 47, wherein the body is formed  
with a cam portion that engages the engagement pawl formed to the specific spool.

49. An ink sheet cartridge, comprising:  
at least three spools;  
a cartridge body that rotatably supports the spools;  
an intermediate connector having a substantially-cylindrical shape and  
detachably connected to one of the at least three spools and unconnected to remaining spools  
of the at least three spools;  
a supply-side core tube having two ends opposite from each other;  
a takeup-side core tube having two ends opposite from each other; and  
an ink sheet wound around and expanding between the supply-side core tube  
and the takeup-side core tube, wherein the intermediate connector and the remaining spools  
of the at least three spools are detachably engaged with the corresponding ends of the supply-  
side core tube and the takeup-side core tube.

50. The ink sheet cartridge according to claim 49, wherein one of the remaining spools is detachably engaged with the opposite end of the end that the intermediate connector is engaged.

51. The ink sheet cartridge according to claim 50, wherein the other spools of the remaining spools is detachably engaged with the other core tube than the one that the intermediate connector is engaged.

52. An ink sheet cartridge, comprising:

a tube-like supply-side member having two ends opposite from each other, a shaft being provided at the two ends respectively;

a tube-like takeup-side member having two ends opposite from each other, a shaft being provided at one end;

an intermediate connector having a substantially-cylindrical shape and detachably connected to the other end of the tube-like takeup-side member;

a specific spool detachably engageable to the intermediate connector, the specific spool having a shaft;

a cartridge body that rotatably supports the shafts; and

an ink sheet wound around and expanding between the tube-like supply-side member and the tube-like takeup-side member.

53. The ink sheet set according to claim 45, wherein the ink sheet has a predetermined width, and a total width of the takeup-side core tube with the intermediate connector being engaged to the takeup-side core tube is substantially equal to a width of the supply-side core tube.

54. The ink sheet set according to claim 44, wherein the one of the ends is provided with a gear, and the intermediate connector is a one-way clutch that transmits a rotational movement only in a single rotational direction of the gear to one of the supply-side core tube and the takeup-side core tube.

55. A core tube used in an ink sheet set including an ink sheet having a predetermined width, the core tube comprising:

an intermediate connector; and

a body having a cylindrical shape with two ends opposite from each other, one of the two ends being engageable with the intermediate connector, wherein

a total width of the body with the intermediate connector being engaged to the body is equal to the predetermined width of the ink sheet.

56. The core tube according to claim 55, wherein the one of the two ends is provided with a gear, and the intermediate connector is a one-way clutch that transmits a rotational movement only in a single rotational direction of the gear to the body.

57. A core tube around which an ink sheet having a predetermined width is wound, the core tube being detachably and rotatably mountable on an ink sheet cartridge by a first spool having a gear and a second spool, the core tube comprising:

an intermediate connector being engageable with the first spool; and

a body having two ends opposite to one another, one of the two ends being engageable with the intermediate connector, another one of the two ends being engageable with the second spool, wherein

the body is rotatably and detachably mountable onto the ink sheet cartridge by the first spool and the second spool only in a condition where the body is engaged with the intermediate connector at the one of the two ends.

58. The core tube according to claim 57, wherein the intermediate connector is a one-way clutch that transmits a rotational movement only in a single rotational direction of the gear to the body.

59. A method of assembling an ink sheet cartridge, comprising the steps of:

attaching a spool to each of two ends of a supply-side core tube;

attaching a third spool to one end of a take-up side core tube having two ends;

and

attaching an intermediate connector to the other end of the take-up side core tube;

attaching the intermediate connector to a fourth spool supported on a cartridge body so that rotation of the intermediate connector integrally rotates the take-up side core tube;

supporting the three spools on the cartridge body.

60. The method according to claim 59, further comprising the step of supporting the fourth spool on the cartridge body.

61. The method according to claim 60, wherein the step of supporting the fourth spool includes the steps of inserting a shaft member of the fourth spool into an orifice of the cartridge body and engaging the shaft member with a first rotation member of the fourth spool.

62. The method according to claim 59, wherein the step of attaching an intermediate connector includes the step of engaging an engagement groove formed in the take-up side core tube with an engagement protrusion formed in the intermediate connector.

63. The method according to claim 62, further comprising the step of preparing the take-up side core tube formed with an outer diameter substantially equal to an outermost diameter of the intermediate connector.

64. The method according to claim 62, further comprising the step of preparing the take-up core tube formed with the engagement grooves of a number equal to or greater than a predetermined number of engagement protrusions formed in the intermediate connector.

65. The method of claim 59, further comprising the step of rotating the take-up side core tube mounted on the cartridge body by the third and fourth spools in a condition in which a rotational direction of the take-up side core tube is regulated by the intermediate connector.

66. A method of using a core tube body, the method comprising the steps of:  
preparing a core tube body having two ends with an engagement groove, the core tube having an outer diameter equal to an outermost diameter of an intermediate connector and being formed with engagement grooves, a number of the engagement grooves being equal to or greater than a predetermined number of engagement protrusions formed in the intermediate connector;

engaging the engagement groove with the engagement protrusion formed to the intermediate connector;

mounting the core tube body rotatably on an ink sheet cartridge with the intermediate connector engaged to the core tube body; and

rotating the core tube body in a condition in which a rotational direction of the core tube body is regulated by the intermediate connector.

67. A method of using an intermediate connector, the method comprising the steps of:

preparing an ink sheet having a predetermined width and being wound around both a supply-side core tube and a take-up side core tube; and

engaging one of two opposite ends of the take-up side core tube with the intermediate connector to provide a total width of the take-up side core tube, with the intermediate connector engaged to the take-up side core tube, equal to a width of the supply-side core tube.

68. The method according to claim 67, wherein the width of the supply-side core tube is in equal to the predetermined width of the ink sheet.

69. The method according to claim 67, further comprising the steps of:  
mounting the take-up side core tube rotatably on an ink sheet cartridge with  
the intermediate connector being engaged to the take-up side core tube; and  
rotating the take-up side core tube in a condition in which a rotational  
direction of the take-up side core tube is regulated by the intermediate connector.

70. A method of using a core tube body, the method comprising the steps of:  
preparing a core tube body wound with an ink sheet having a predetermined  
width;  
engaging one of two ends of the core tube body with an intermediate  
connector;  
engaging the intermediate connector with a first spool having a gear;  
engaging another one of the two ends of the core tube body with a second  
spool; and

allowing a user to mount the core tube body rotatably and detachably onto an  
ink sheet cartridge by the first spool and the second spool only when the core tube body is  
engaged with the intermediate connector at the one of the two ends.

71. The method according to claim 70, further comprising the step of rotating the  
core tube body in a condition in which a rotational direction of the core tube body is regulated  
by the intermediate connector.

72. An ink sheet set used in combination with a spool having a tip end formed  
with a protrusion, the ink sheet set comprising;  
an ink sheet having a predetermined width;  
a supply-side core tube on which the ink sheet is wound;  
a take-up side core tube that takes up the ink sheet thereonto, the take-up side  
core tube having a first end and a second end opposite to the first end; and  
an intermediate connector that engages the first end of the take-up side core  
tube and that is engageable with the tip end of the spool, wherein the intermediate connector  
is formed with a groove for engaging the protrusion formed to the tip end of the spool.

73. An ink sheet set used in combination with a spool having a tip end formed  
with a protrusion, the ink sheet set comprises;  
an ink sheet having a predetermined width;

a supply-side core tube on which the ink sheet is wound;

a take-up side core tube that takes up the ink sheet thereonto, the take-up side core tube having a first end and a second end opposite to the first end; and

an intermediate connector that engages the first end of the take-up side core tube and that is engageable with the tip end of the spool, the intermediate connector being formed with a groove, wherein the groove is formed to the intermediate connector at a position that locates inside the first end of the take-up side core tube when the intermediate connector is in engagement with the first end, such that when the intermediate connector is in engagement with the first end, the groove engages the protrusion inside the first end.

74. An ink sheet set used in combination with a spool having a tip end formed with a protrusion, the ink sheet set comprises;

an ink sheet having a predetermined width;

a supply-side core tube on which the ink sheet is wound;

a take-up side core tube that takes up the ink sheet thereonto, the take-up side core tube having a first end and a second end opposite to the first end; and

an intermediate connector that engages the first end of the take-up side core tube and that is engageable with the tip end of the spool, the intermediate connector being formed with a groove, wherein the groove is formed at a position which locates at a predetermined position inside the first end of the take-up side core tube when the intermediate connector is in engagement with the first end, the predetermined position being where the protrusion formed to the tip end of the spool locates and engages the groove when the spool is engaged with the intermediate connector.

75. An ink sheet set used in combination with an ink ribbon cassette and a spool mounted on the ink ribbon cassette, the spool having a tip end formed with a protrusion, the ink sheet set comprising;

an ink sheet having a predetermined width;

a supply-side core tube on which an ink sheet is wound;

a take-up side core tube that takes up the ink sheet thereonto, the take-up side core tube having a first end and a second end opposite to the first end; and

an intermediate connector that engages the first end of the take-up side core tube, the intermediate connector being formed with a groove engageable with the protrusion formed to the tip end of the spool.

76. An ink sheet set used in combination with an ink ribbon cassette and a spool mounted on the ink ribbon cassette, the spool having a tip end formed with a protrusion, the ink sheet set comprising:

an ink sheet having a predetermined width;  
a supply-side core tube on which the ink sheet is wound;  
a take-up side core tube that takes up the ink sheet thereonto, the take-up side core tube having a first end and a second end opposite to the first end; and

an intermediate connector that engages the first end of the take-up side core tube and that is engageable with the tip end of the spool, the intermediate connector being formed with a groove, wherein the groove is formed to the intermediate connector at a position that locates inside the first end of the take-up side core tube when the intermediate connector is in engagement with the first end, such that when the intermediate connector is in engagement with the first end, the groove engages the protrusion inside the first end.

77. An ink sheet set used in combination with an ink ribbon cassette and a spool mounted on the ink ribbon cassette, the spool having a tip end formed with a protrusion, the ink sheet set comprising:

an ink sheet having a predetermined width;  
a supply-side core tube on which the ink sheet is wound;  
a take-up side core tube that takes up the ink sheet thereonto, the take-up side core tube having a first end and a second end opposite to the first end; and  
an intermediate connector that engages the first end of the take-up side core tube and that is engageable with the tip end of the spool, the intermediate connector being formed with a groove, wherein the groove is formed at a position which locates at a predetermined position inside the first end of the take-up side core tube when the intermediate connector is in engagement with the first end, the predetermined position being where the protrusion formed to the tip end of the spool locates and engages the groove when the spool is engaged with the intermediate connector.